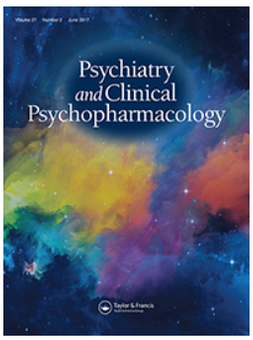

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Validity of Turkish form of Pain Catastrophizing Scale and modeling of the relationship between pain-related disability with pain intensity, cognitive, and emotional factors

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ABSTRACT

Objective: Pain is one of the significant physical manifestations leading to disability. When investigating disability due to painful chronic diseases, either the particular effect of pain is not adequately separated from other symptoms of the disease, or only the focus is on the physical component of the pain. Therefore, the role of cognitive and emotional factors on disability has been reversed. But recently, attention is increasingly drawn to the role of cognitive and emotional factors in the pathophysiology and treatment of pain. The purpose of this study is to investigate the validity and reliability of the Turkish version of the Pain Catastrophizing Scale (PCS) evaluating cognitive characteristics of pain and is to reveal the relationship between the severity of pain, cognitive and emotional factors and disability through a model.

Methods: The study was conducted with 216 patients with the rheumatologic disease with chronic pain for at least six months. In the validity–reliability analyses, Cronbach's alpha, inter-item and item-total correlations, test–retest correlation, and confirmatory factor analysis were applied. Automatic Thoughts Questionnaire was given for parallel test validity. The effects of the physical, cognitive, and emotional components of the pain on disability were assessed with Brief Symptom Inventory, Visual Analog Scale, PCS, and Pain Disability Index and analyzed with Structural Equation Modelling.

Results: Cronbach's alpha for PCS' Turkish form was 0.955. Inter-item and item-total correlation were between 0.488 and 0.848. Intraclass correlation coefficient was 0.830. Confirmatory factor analysis confirmed the three-factor model of PCS. Path model showed that pain-related disability is affected not only by the physical properties of the pain but also by the direct and indirect cognitive and emotional factors. Gender and duration of pain are covariates.

Discussion: It is important to determine the severity of pain in the evaluation of pain, but the emotional and cognitive characteristics of the pain should also be in this assessment. Turkish version of the PCS can be used in this evaluation. Our study showed that cognitive and emotional interventions, both directly and indirectly, may be positively reflected in the results of attempts to reduce pain-related disability.

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Catastrophizing; cognitive; disability; emotional; pain; validity

Introduction

Pain is no longer just a concept defined by physical components. Cognitive and emotional aspects are other key factors that determine the pain experience [1]. Psychological factors, such as depression and anxiety, are frequently seen in individuals with chronic pain, affect treatment outcomes, and impair functioning [2–5]. Likewise, the fact that cognitive behavioral therapies are effective in treating chronic pain supports the importance of cognitive factors in chronic pain [6,7]. One of the cognitive factors, catastrophizing, is defined as a predisposition to magnify a perceived threat and overestimate the seriousness of its potential consequences [8].

The pain-related disability has been investigated in many studies [9–11]. However, in these studies, the effects of the disability of symptoms other than pain of the pain-causing illness have not been adequately resolved or, because of more emphasis is placed on the biological aspects of pain, the direct or indirect effects of the emotional and cognitive components of the pain on the disability have remained on the back.

In assessing pain and pain-related disability, not only the physical characteristics (frequency, duration or intensity) of the pain but also the cognitive and emotional components should be considered [12,13]. In this regard, PCS is one of the essential tools for presenting pain-related cognitions [14,15]. In clinical practice, especially in patients who do not respond adequately to pain relief interventions, use with other emotional evaluating tools may provide superiority in the development of treatment protocols, patient follow-up, and decreasing disability.

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The aim of this study is to show the validity and reliability of the Turkish form of PCS and is to reveal the direct and indirect effects of the physical, emotional, and cognitive aspects of pain in pain-related disability.

Methods

Translation procedure

The PCS was translated from its original English version into Turkish according to a standardized procedure [16,17]. In the first step, PCS was translated into Turkish, and these translations were combined final version by two native Turkish speakers. In the second step, a final Turkish version of the questionnaire was translated back into English by another researcher. In the third step, all of the researchers of study have met and evaluated the entire PCS version and approved the pre-final version of PCS. A subgroup of patients with a rheumatologic disease ($n = 10$) performed this pre-final version, and all of them were asked that they could clearly understand the questions and interpret them correctly. Their answers were discussed among the study researchers, and its Turkish version was finalized (see Appendix I).

Subjects and testing

We have included rheumatic patients with chronic pain in the study. Permission was obtained for our study via email from Mr Michael John L. Sullivan (Ph.D. Professor of Psychology, Medicine and Neurology Canada Research Chair in Behavioural Health), who developed the original PCS scale and ethical committee approval was obtained for our study.

This study included 216 patients. The inclusion criteria were as follows: being between the ages of 18 and 65, being a rheumatologic patient with muscle–joint–tissue pain for the last six months, and being literate. Exclusion criteria for the study: being younger than 18 years or older than 65 years, patients who are physically restricted due to other symptoms of the rheumatic disease other than pain (patients with significant joint deformities, patients who are mobilized with assistance or who are not mobilized, etc.), the presence of additional medical illnesses that are not controlled or cause significant disability (uncontrolled DM, uncontrolled HT, orthopedic disability, neurological disease, or neurological involvement of rheumatologic disease), and being treated for any psychiatric illness, presence of mental retardation.

Patients were given written instructions to respond to the PCS, a Visual Analog Scale (VAS), Brief Symptom Inventory (BSI), Automatic Thoughts Questionnaire (ATQ), and the Pain Disability Index (PDI). Patients also answered questions that screened for sociodemographic characteristics, current medical and/or psychiatric problems, and a total duration of chronic pain. Each patient was first introduced to the scales and approximately 30 minutes were given to complete the scales. In the study, the PCS was given to a subgroup of 20 randomly selected patients for test–retest analysis again after one week.

The PCS a 13-item self-report inventory that uses the 5-point Likert scale (0–4) was developed by Sullivan et al. to measure the extent to which people catastrophize in response to pain. The original scale consists of three sub-factors called helplessness, magnification, and rumination [14]. As far as we can investigate, the scale was used in two studies in Turkey [18,19]. Only one of them was given a Cronbach's alpha value for reliability of the scale [19].

The VAS was used to measurement of pain severity. It is a common instrument used worldwide with tested validity and reliability [20]. Patients with chronic pain were instructed to make an assessment by taking into account their ongoing pain over the last week.

The BSI is an instrument that evaluates psychological or psychiatric pathology in people. The test can be used for areas such as patient progress, treatment measurements, and psychological assessment. The BSI is a 53-item self-report scale that uses the 5-point Likert scale [21]. The Turkish validity–reliability study of the scale was conducted by Sahin et al. [22].

The PDI is a self-reporting questionnaire that measures the degree to which pain presently interferes with living in the following seven areas; family and/or home responsibilities, leisure activity, social activity, occupation, sexual behavior, self-care, and life-support activities [23]. The Turkish validity–reliability study of the scale was conducted by Ugurlu et al. [24].

The ATQ measures the frequency of automatic negative thoughts related to depression. It is a Likert-type scale with 1–5 points and consists of 30 items. The Turkish validity–reliability study of the scale was conducted by Sahin and Aydı [25,26].

Statistical analysis

A confirmatory factor analysis (maximum likelihood estimation) was performed for the PCS. The goodness-of-fit was evaluated using four criteria: the goodness-of-fit index (GFI), comparative fit index (CFI), the root-mean-square error of approximation (RMSEA), and the ratio of the chi-squared value to its degrees of freedom (χ^2/df). To determine the convergent validity of the PCS were examined using the Pearson correlation technique. Cronbach's alpha coefficient, test–retest, and ICC were also used for testing the reliability of the PCS scale. Floor and ceiling effects were examined by considering the number of individuals that obtained the lowest (0) or highest (52) scores possible and were assumed to be present if more than 15% of the participants achieved the highest or lowest score [27].

In the path analysis, we have studied the relationship between catastrophizing (PCS), pain intensity (VAS), emotional factors (BSI), and disability (PDI). Path analysis can be used to describe the effects of exogenous variables (i.e. gender or pain duration) on endogenous (PCS, BSI, VAS) variables directly, indirectly, and by the sum of these variables. Path analysis enables an easy understanding of these effects by visualization in a path diagram [28]. Path analysis can predict that the equations system determines all causal links in a variables system, solves complex relationships between variables, and clearly reveals the strength of the relationship [29]. Suhr stated that if a path coefficient value is smaller than 0.10, there is the presence of a weak effect; if a path coefficient value is between 0.10 and 0.50, there is the presence of a moderate effect; if a path coefficient value is greater than 0.50, there is the presence of a strong effect [30].

Results

Sample and reliability analysis

Our research sample consisted of 216 patients. Demographic and clinical characteristics of the participants were shown in Table 1. Ceiling and floor effects were not detected (Figure 1).

According to Hotelling's T-square results, the scale items are homogeneous ($F = 18.001$, $p < .001$), and additive (Tukey test for nonadditivity, $F = 0.260$, $p = .610$). Cronbach's alpha was used for internal consistency analysis of the PCS and was determined to be $r = 0.955$ for the entire test. Cronbach alpha values of hopelessness and magnification and rumination subscales were 0.909, 0.856, and 0.906, respectively. None of the Cronbach's alpha values improved when any item was deleted. The test–retest method was used to determine the reliability of the scale, and the PCS was given again for this purpose about one week after the first test to 20 randomized patients (there were no significant difference in gender ratio, education level, mean age, and VAS total score between random subgroup and study sample) from among the original sample of participants. We found that the test–retest Pearson correlation coefficient of the PCS total score was 0.714 ($p < .001$) in subgroup. Intraclass correlation coefficient ($ICC_{(2,1)}$) was 0.830. The inter-item and item-total correlations are listed in Table 2.

Table 1. Demographic and clinical features of participants.

		N	%
Gender	Male	34	15.7
	Female	182	84.3
Education	Primary school	144	69.2
	High school	42	20.2
	University	22	10.6
Rheumatic disease	RA	88	42.7
	SS	41	19.9
	AS	24	11.7
	PSS	14	6.8
	CTD	14	6.8
	Other	14	6.8
	FMF	11	5.3
		Mean	SD
Age		47.8	10.2
Pain duration		8.7	6.9
ATQ		50.7	23.6
BSI		51.93	37.9
PDI		24.8	14.4
PCS		20.1	14.3
VAS		60.8	23.0

Note: RA: rheumatoid arthritis, SS: seronegative spondyloarthropathies, AS: ankylosing spondylitis, PSS: primary Sjogren's Syndrome, CTD: connective tissue disease, FMF: familial Mediterranean fever, ATQ: Automatic Thought Scale, BSI: Brief Symptom Inventory, PDI: Pain Disability Index, PCS: Pain Catastrophizing Scale, VAS: Visual Analog Scale.

Validity analysis

The confirmatory factor analysis was used for three-factor model and the results were as follows: GFI = 0.917, CFI = 0.972, $\chi^2/df = 1.989$, RMSEA = 0.068 (Figure 2). Convergent validity was assessed as a result of an examination of the relationships between PCS and ATQ total scores using correlation analysis. According to this analysis, there was a significant correlation between PCS and ATQ ($r = 0.581$ and $p < .001$).

Relationships among gender, pain duration, pain intensity, catastrophizing, emotional factors, and pain-related disability

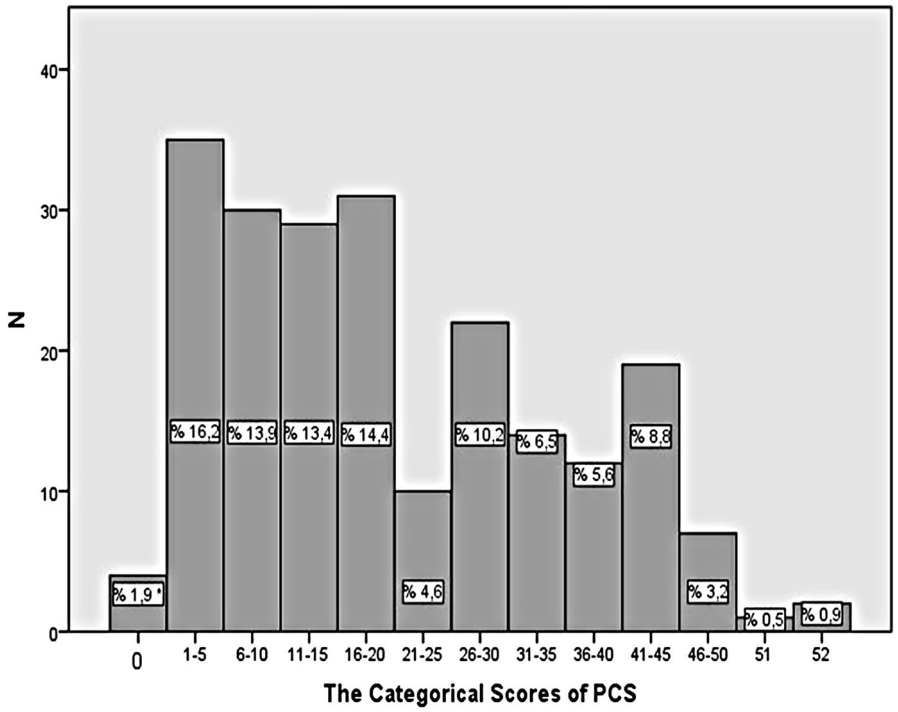
Figure 3 shows statistically significant relationships between variables and the magnitudes of these relations with standardized regression coefficients. There are six variables in the model. Gender and duration of pain were added as a covariate in the model. It was found that gender (being a woman) had a significant effect on only BSI scores (standardized path coefficient (spc) = 0.15), but not on other variables. The duration of pain was found to be significant only on VAS (spc = 0.12), but not significant on other variables.

The relationship between the variables in the main model where the PDI is the outcome variable is as follows. The increase in BSI scores increases both PCS (spc = 0.60) and PDI (spc = 0.18). There are no direct effects of BSI scores on VAS. An increase in the scores of the PCS leads to an increase in both VAS scores (spc = 0.39) and PDI scores (spc = 0.19). The increase in VAS scores increases pain-related disability (spc = 0.40).

Discussion

Validity–reliability of Turkish form of PCS

Our study reveals a successful translation of the PCS into Turkish. The translation was shown to have good reliability (Cronbach's alpha = 0.955). In the original scale development study, Sullivan et al. found an internal



PCS : Pain Catastrophizing Scale

Floor and Ceiling Effect : Floor and Ceiling effect is the case if the highest or lowest scores on the scale are 15 % or more of all responses. This means that the scale will not be able to make enough distinction for extreme values. The graph shows that there is no floor and ceiling effect.

Figure 1. Floor and ceiling effect.

consistency of the scale of $r = 0.87$ [14]. In various studies, Cronbach's alpha of the PCS total score was found to be between 0.90 and 0.93 [15,19,31]. Confirmatory factor analysis verified the three-factor model [14] of PCS and all factor loadings were greater than 0.7. The PCS scores were positively correlated to the ATQ which is another scale that evaluates cognitive distortions.

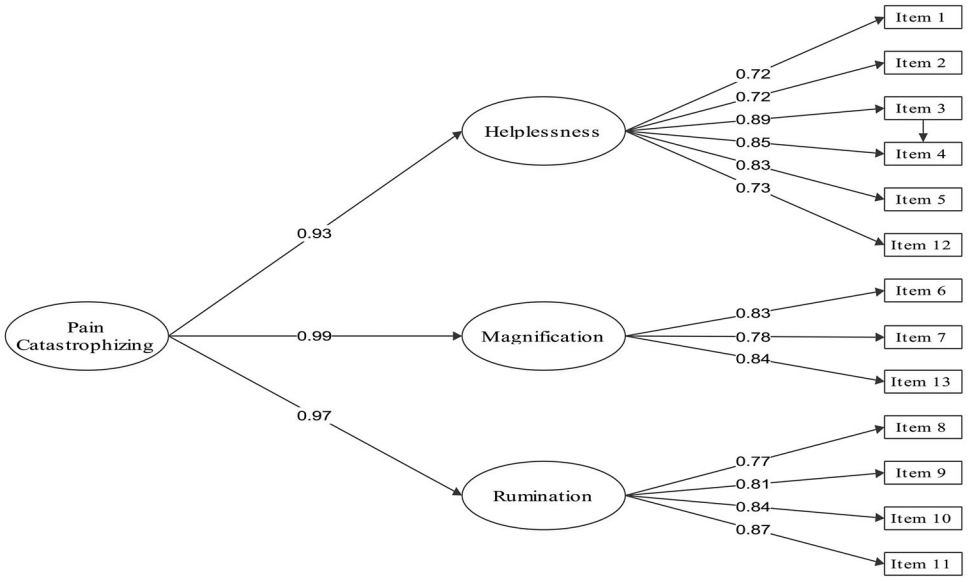
In a reliability analysis of a scale, the small correlation between any two items indicates that the two items measure different things. However, the fact that any item of the scale has a weak correlation with the total scores of the scale suggests that the item does not adequately measure what should be measured and ıt may be dropped [32,33]. As shown in Table 2, although inter-item correlations are not as small as desired, item-total correlations are high. Therefore, it can be said that each item measures the catastrophic thoughts related to pain.

Although most of the participants being the woman seems to be a limitation, rheumatic diseases have high female/male ratios [34,35]. Therefore, the high proportion of participants in the study sample is

Table 2. Inter-item and item-total correlation of PCS Turkish form.

	Item-total correlation	Inter-item correlation											
	PCS-T	PCS1	PCS2	PCS3	PCS4	PCS5	PCS6	PCS7	PCS8	PCS9	PCS10	PCS11	PCS12
PCS1	0.705	1											
PCS2	0.686	0.598	1										
PCS3	0.842	0.622	.656	1									
PCS4	0.791	0.589	.558	0.773	1								
PCS5	0.772	0.571	.579	0.767	0.748	1							
PCS6	0.786	0.520	0.559	0.746	0.655	0.641	1						
PCS7	0.745	0.576	0.489	0.603	0.614	0.551	0.641	1					
PCS8	0.743	0.612	0.521	0.616	0.562	0.559	0.605	0.579	1				
PCS9	0.781	0.584	0.550	0.653	0.639	0.635	0.671	0.599	0.632	1			
PCS10	0.792	0.557	0.532	0.690	0.625	0.640	0.617	0.634	0.648	0.657	1		
PCS11	0.816	0.553	0.539	0.682	0.639	0.625	0.660	0.693	0.641	0.688	0.767	1	
PCS12	0.729	0.543	0.540	0.596	0.655	0.572	0.565	0.589	0.577	0.567	0.613	0.644	1
PCS13	0.798	0.553	0.578	0.700	0.598	0.594	0.703	0.648	0.651	0.668	0.656	0.720	0.621

Note: Each cell shows the correlation coefficient between the PCS's inter-items or item-PCS's total score.
For all correlation coefficients: $p < .001$.
PCS: Pain Catastrophizing Scale, PCS-T: Pain Catastrophizing Scale Total Score.



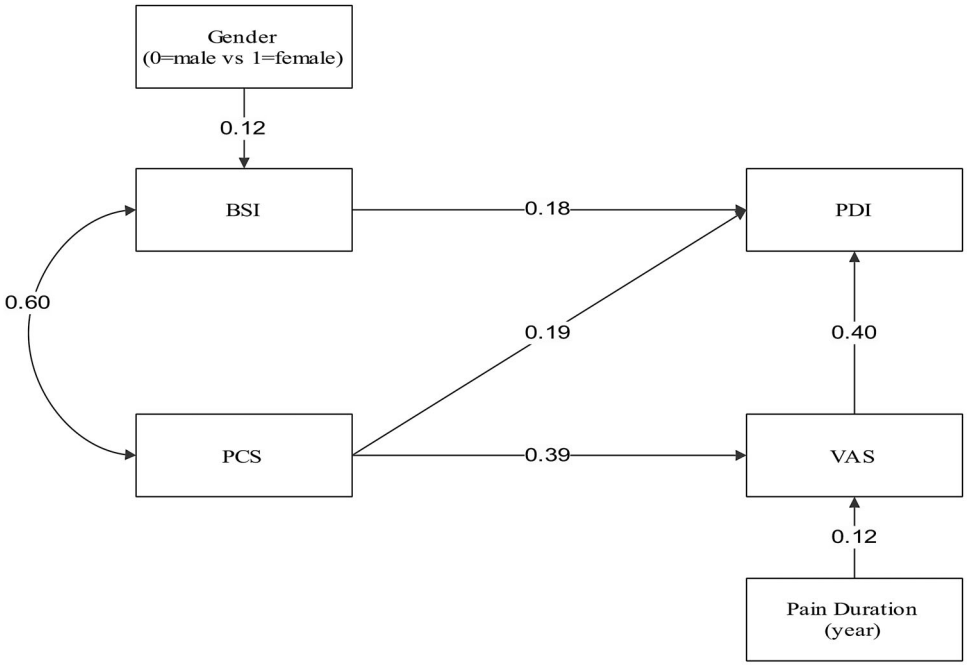
CMIN/DF	P	GFI	CFI	RMSEA
1.989	< 0.001	0.917	0.972	0.068

CMIN/DF : Chi-squared value to its degrees of freedom, **GFI:** Goodness-of-Fit Index, **CFI:** Comparative Fit Index, **RMSEA:** Root-Mean-Square Error of Approximation
The numbers on the arrows indicate the standardized regression coefficient.

The Confirmatory Factor Analysis has also confirmed that the Turkish form of the Pain Catastrophizing Scale is also 3-factor.

Figure 2. Confirmatory factor analysis for PCS.

contributing to the generalizability of the results because study sample adequately represents the population. In conclusion, the Turkish version of PCS had adequate psychometric properties in rheumatic patients with chronic pain, regarding its internal consistency, test–retest reliability, convergent validity, and factorial structure.



CMIN/DF	P	GFI	CFI	RMSEA
0.477	0.873	0.994	1	0

BSI : Brief Symptom Inventory, **PCS :** Pain Catastrphizing Scale, **PDI** : Pain Disability Index, **VAS :** Visual Analog Scale
CMIN/DF : Chi-squared value to its degrees of freedom, **GFI:** Goodness-of-Fit Index, **CFI:** Comparative Fit Index, **RMSEA:** Root-Mean-Square Error of Approximation
The numbers on the arrows indicate the standardized regression coefficients.

The figure shows that there is a strong correlation between BSI and PCS scores. While the BSI (negative emotions) affects PDI (disability) only directly and moderately, PCS (negative cognition) affects PDI both directly and indirectly (by affecting the VAS scores) and moderately. Pain duration and gender are covariates.

Figure 3. Relationship among BSI, PCS, PDI, and VAS.

Modeling the direct and indirect effects of pain components in pain-related disability

Our study showed that three components of pain (physical, cognitive, and emotional) are effective on pain-related disability. It has also been shown that pain intensity is a moderate and directly effect on disability. In particular, the pain associated with the musculoskeletal system is increasing with movement. Indeed, it has been shown that the thinking of the movement stimulates pain centers in the brain [36]. Restraint of movement due to pain causes disability. The more severe the pain, the greater the activity limitation [37].

The model revealed a strong, positive, and reciprocal relationship between catastrofizing and psychiatric symptomatology. There is a complex relationship between behaviors, emotion, and cognition. Pain-induced disability is in fact a result of some kind of pain behavior [38]. Catastrophizing affects pain-related disability both by increasing the intensity of pain (indirect path) and directly. This effect is of medium size. The role of catastrophizing and emotional factors in pain experience has been shown in previous studies [39,40]. In the model, the fact that affective symptoms do not seem to be effective on the VAS scores is probably due to the high correlation between catastrophizing and emotional factors. As a matter of fact, when the effect of emotional factors was examined in the models established before the primary model, the emotional factors had a weak effect on the pain intensity, but this effect was removed from the model because it was not significant.

One of the significant results of the study is that cognition and emotion independently of the VAS scores cause an increase in pain-related disability. This may be due to measurement errors caused by other factors that may cause disability, other than pain. However, this limitation has been tried to be solved by controlling the other factors that may cause disability in the course of sampling selection. On the other hand, we can think of the physical properties of pain as an obstacle that complicates daily activities and the general physical, psychological, and cognitive capacities of the patient as forces to overcome these obstacles. As the intensity of the pain increases, this barrier will grow and the disability will increase. The disability resulting from pain will be tried to be overcome with current cognitive, emotional, and physical capacity. In this case, psychological and cognitive problems will weaken the compensation mechanisms and increase disability.

This study is consistent with findings that emotional and cognitive factors have an effect on the physical properties of the pain [6,40,41]. But at the same time, it is important that our study shows that cognitive and emotional factors directly affect pain-related disability. It can be said that these results are valuable for increasing the importance of psychological approaches such as cognitive behavioral therapies that have been shown to be effective in the treatment of chronic pain.

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Disclosure statement

No potential conflict of interest was reported by the authors.

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Appendix I

AĞRIYI FELAKETLEŞTİRME ÖLÇEĞİ

Adı / Soyadı_____ Tarih: _____

Hemen herkes hayatının bir döneminde ağrıya neden olan durumlar yaşamıştır. Örneğin baş ağrısı, diş ağrısı, eklem ya da kas ağrıları gibi. İnsanlar sıklıkla ağrıya neden olabilen hastalıklar, travmalar (kazalar), diş hastalıkları ile ilgili işlemler ya da cerrahi uygulamalar gibi durumlara maruz kalabilirler.

Biz ağrı yaşadığınız zamanlardaki duygu ve düşüncelerinizle ilgileniyoruz. Aşağıda ağrıyla ilişkili olabilen farklı duygu ve düşünceleri tanımlayan 13 durum sıralanmıştır. Lütfen ölçeği kullanarak, *ağrı yaşadığınız anlardaki* duygu ve düşüncelerinizin derecesini işaretleyiniz.

	Hiç yok	Hafif derece	Orta derece	Büyük ölçüde	Her zaman
Ağrının sona erip ermeyeceği konusunda sürekli endişelenirim	0	1	2	3	4
(Ağrı nedeniyle) Devam edemeyeceğimi hissederim	0	1	2	3	4
Ağrının korkunç olduğunu ve asla düzelmeyeceğini düşünürüm	0	1	2	3	4
Ağrı berbat bir şeydir ve beni bunalttığını hissederim	0	1	2	3	4
Ağrıya daha fazla dayanamayacağımı hissederim	0	1	2	3	4
Ağrının kötüleşeceğinden korkarım	0	1	2	3	4
Sürekli olarak başka ağrılı durumları düşünürüm	0	1	2	3	4
Endişeli biçimde ağrının geçmesini dilerim	0	1	2	3	4
Ağrıyı kafamdan atamıyorum	0	1	2	3	4
Sürekli olarak ağrının canımı ne kadar yaktığını düşünürüm	0	1	2	3	4
Ağrının geçmesini beklemenin ne kadar zor olduğunu düşünüp dururum	0	1	2	3	4
Ağrının şiddetini azaltmak için yapabileceğim hiçbir şey yok	0	1	2	3	4
Ağrının ciddi bir sorunla ilgili olup olmadığını merak ederim	0	1	2	3	4